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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-296532
(43)Date of publication of application : 12.11.1996

(51)Int.Cl. F02M 61/18
F02M 61/18
F02M 51/06
F02M 51/08

(21)Application number : 08-145945
(22)Date of filing : 07.06.1996

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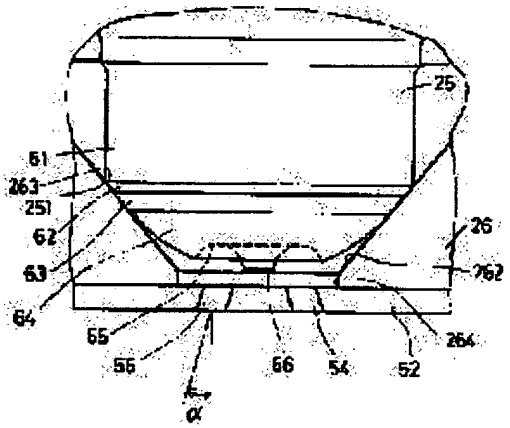
(54) FLUID INJECTION NOZZLE

(57)Abstract:
PURPOSE: To provide a fluid injection nozzle that increases the turbulence of fluid flow so as to expedite the atomization of an injected fluid.
CONSTITUTION: When a needle that can come in contact with a part of the conical slant face 262 of a valve body 26 is spaced from the conical slant face 262, fuel flows into a space formed being partitioned by the tip part curved surface of the needle 25, the conical slant face 262 of the valve body 26 and the inlet face of an orifice plate 52. The main stream of this fuel flows along the spherical surface 64 so as to be drawn to an annular groove 65 without escaping directly from orifices 54, 56, and the fuel flow becomes unstable in the space. The direction is then controlled by the orifices 54, 56, and the fuel is injected from the orifices 54, 56. The injected fuel thereby becomes fuel spray expedited in atomization.



LEGAL STATUS

[Date of request for examination] 25.01.2002
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
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CLAIMS

[Claim(s)]
[Claim 1] It has the contact section which can contact the valve body which has the cone slant face which forms passage in the interior, and said a part of cone slant face. The needle in which said a part of cone slant face, contact, and alienation are possible, The outlet side of said cone slant face of said valve body is equipped with the plate for flow directional control which has the hole which lets a mounting eclipse and a fluid pass. Said hole The fluid injection nozzle which is the orifice penetrated in the direction of board thickness of said plate for flow direction control, and is characterized by being in the direction core side of a path rather than the location where the mainstream direction of the fluid of the downstream of said contact section intersects the inlet-port side of said plate for flow direction control.
[Claim 2] Said needle is a fluid injection nozzle according to claim 1 characterized by having the curved surface formed in a point, and the slot in a circle formed in the surroundings of the needle medial axis of this curved surface at a concave.
[Claim 3] Said needle is a fluid injection nozzle according to claim 1 characterized by having the curved surface annularly formed in a point, and the flat side formed so that it may project in the center section of this curved surface at said plate side for flow direction control.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the injection nozzle section of the electromagnetic fuel injection valve which injects a fuel to the internal combustion engine for automobiles, for example, is supplied about a fluid injection nozzle.
[0002]
[Description of the Prior Art] Generally, the fuel injection valve used for an internal combustion engine contains valve portion material possible [both-way sliding] to the advice hole formed in the shaft orientations of a valve body, and the nozzle hole which carries out opening to the point of a valve body is opened and closed by vertical movement of valve portion material. For this reason, the amount of lifts at the time of valve opening is controlled by the precision so that valve portion material secures proper fuel oil consumption.
[0003] "Atomization of a fuel" injected in such a fuel injection valve from viewpoints, such as operability by which reduction of fuel consumption, improvement in exhaust air emission, and an internal combustion engine were stabilized, to a nozzle hole is one of the important elements. Although there is an auxiliary atomization means by the collision of the air to an injection fuel, heating near a nozzle hole, etc. as an approach of promoting the atomization of an injection fuel, each of these atomization means has the problem of becoming expensive.
[0004] Although various the approaches of, preparing the orifice plate which formed the stoma in the point of a fuel injection valve on the other hand, and promoting atomization were also considered, while turbulence sufficient with the configuration found by JP,3-26476,A, for example for fuel flow had not been given, it spouted from the direct orifice to the exterior, and there was a trouble that sufficient atomization was not attained. The object of this invention is to offer the fluid injection nozzle which atomizes the fuel with which turbulence of the fuel style before injection is injected by atomization paying attention to the phenomenon of influencing greatly.
[0005] Other objects of this invention are to offer the fluid injection nozzle which gave turbulence in the style of [in front of a atomization means] the fuel.
[0006]
[Means for Solving the Problem] The valve body which has the cone slant face where the fluid injection nozzle of this invention according to claim 1 forms passage in the interior, It has the contact section which can contact said a part of cone slant face. The needle in which said a part of cone slant face, contact, and alienation are possible, The outlet side of said cone slant face of said valve body is equipped with the plate for flow directional control which has the hole which lets a mounting eclipse and a fluid pass. Said hole It is the orifice penetrated in the direction of board thickness of said plate for flow direction control, and the configuration characterized by being in the direction core side of a path rather than the location where the mainstream direction of the fluid of the downstream of said contact section intersects the inlet-port side of said plate for flow direction control is adopted.
[0007] The fluid injection nozzle of this invention according to claim 2 is characterized by said needle having the curved surface formed in a point, and the slot in a circle formed in the surroundings of the needle medial axis of this curved surface at a concave in said configuration. The fluid injection nozzle of this invention according to claim 3 is characterized by said needle having the curved surface annularly formed in a point, and the flat side formed so that it may project in the center section of this curved surface at said plate side for flow direction control in said configuration.
[0008]
[0009]
[Function and Effect(s) of the Invention] If the needle which can contact a part of cone slant face of a valve body estranges from said cone slant face according to the fluid injection nozzle of this invention according to claim 1 A fluid

flows in the space by which partition formation is carried out in respect of the inlet port of a needle apical surface, the cone slant face of a valve body, and the plate for flow directional control. In order that the mainstream of this flow may not fall out from the hole of the plate for flow directional control directly but may collide with the plate for flow directional control, after the flow of a fluid becomes instability in said space, a fluid spouts it from the hole of the plate for flow directional control. Therefore, the fluid spouted from the plate for flow directional control becomes the fuel spray by which atomization was promoted in the predetermined direction.

[0010] If a needle estranges from the cone slant face of a valve body according to the fluid injection nozzle of this invention according to claim 2, a fluid flows in the space by which partition formation is carried out in respect of the inlet port of a needle apical surface, the cone slant face of a valve body, and the plate for flow directional control, the mainstream of this fluid can be drawn near to the slot in a circle on the needle, and a vortex will be formed in space. Therefore, the fluid in this space does not fall out from the hole of the plate for flow directional control directly, but the atomization of the fluid spouted from the plate for flow directional control is promoted.

[0011] According to the fluid injection nozzle of this invention according to claim 3, the flow of a fluid becomes instability in the space by which partition formation is carried out in respect of the curved surface annularly formed in the point of a needle, the flat side formed in the center section of this curved surface, a valve body internal surface, and the inlet port of the plate for flow directional control, and the atomization of the fuel spray which directional control is carried out and is spouted from the plate for flow directional control is promoted.

[0012]

[Example] Hereafter, the example of this invention is explained based on a drawing.

(The 1st example) One example which applied this invention to the fuel injection valve of a gasoline engine's fuel supply system is shown in drawing 1 - drawing 6 .

[0013] First, the fuel injection valve as a fluid injection nozzle is explained based on drawing 3 . it is shown in drawing 3 -- as -- the interior of the housing mould 11 made of the resin of the fuel injection valve 10 as a fluid injection nozzle -- the fixed iron core 21, spool 91, and electromagnetism -- a coil 32, the coil mould 31, and the metal plates 93 and 94 as a magnetic path are really fabricated. The fixed iron core 21 consists of a ferromagnetic ingredient, and it is established in the housing mould 11 so that it may project from the upper part of the coil mould 31. The adjusting pipe 29 is being fixed to the wall of the fixed iron core 21.

[0014] the periphery of the spool 91 made of resin -- electromagnetism -- a coil 32 winds -- having -- after that -- spool 91 and electromagnetism -- the coil mould 31 carries out resin shaping at a periphery with a coil 32 -- having -- the coil mould 31 -- electromagnetism -- the coil 32 is surrounded. the coil mould 31 -- electromagnetism -- cylinder-like tubed part 31a which protects a coil 32, and electromagnetism -- while protecting the lead wire electrically drawn from a coil 32, in order to hold the terminal 34 mentioned later, it consists of lobe 31b projected from tubed part 31a to the upper part. and the condition of having been unified by the coil mould 31 -- the periphery of the fixed iron core 21 -- spool 91 and electromagnetism -- it is equipped with a coil 32.

[0015] two metal plates 93 and 94 are formed so that an upper end may touch the periphery of the fixed iron core 21 and the downward other end may touch the periphery of the magnetic pipe 23 -- having -- electromagnetism -- it is the member which forms the magnetic path which lets the magnetic flux at the time of the energization to a coil 32 pass, and it is covered by the periphery of tubed part 31a so that tubed part 31a may be pinched from both sides. these two metal plates 93 and 94 -- electromagnetism -- the coil 32 is protected.

[0016] Connector area 11a is prepared above the housing mould 11 so that it may project from the outer wall of the housing mould 11. and electromagnetism -- the terminal 34 electrically connected to a coil 32 is laid under connector area 11a and the coil mould 31. Moreover, the terminal 34 is connected to the electronic control which is not illustrated through wire harness.

[0017] The end of the compression coil spring 28 contacted the upper bed side of the needle 25 by which welding immobilization is carried out in a moving core 22, and the other end of the compression coil spring 28 is in contact with the pars basilaris ossis occipitalis of an adjusting pipe 29. The compression coil spring 28 energizes a moving core 22 and a needle 25 under drawing 3 , and sits the sheet section of a needle 25 to the valve seat 263 of a valve body 26. the electronic control which is not illustrated -- a terminal 34 to lead wire -- minding -- electromagnetism -- if an exciting current flows in a coil 32, a needle 25 and a moving core 22 will resist the energization force of the compression coil spring 28, and will be attracted in the direction of the fixed iron core 21.

[0018] The nonmagnetic pipe 24 is connected to the lower part of the fixed iron core 21. And edge 24a is connected to the lower part of the fixed iron core 21 so that while may project in part from the soffit of the fixed iron core 21. Furthermore, narrow diameter portion 23b of the magnetic pipe 23 which consisted of a magnetic material and was formed in the shape of a pipe with a stage is connected to the soffit of other-end section 24b of the nonmagnetic pipe 24.

In addition, other-end section 24b of the nonmagnetic pipe 24 is making the advice section of a moving core 22.
[0019] Next, the moving core 22 which consists of a magnetic material and is formed in tubed is established in the building envelope of the nonmagnetic pipe 24 and the magnetic pipe 23. The outer diameter of this moving core 22 is slightly set up small from the bore of other-end section 24b of the nonmagnetic pipe 24, and the moving core 22 is supported by the nonmagnetic pipe 24 possible [sliding]. Moreover, the upper bed side of a moving core 22 is established so that it may counter through the clearance between the soffit side of the fixed iron core 21, and predetermined.
[0020] The joint 43 is formed in the upper part of a needle 25. And laser welding of a joint 43 and the moving core 22 is carried out, and a needle 25 and a moving core 22 are connected with one. 2 beveling as a fuel path is formed in the periphery of a joint 43. Above the fixed iron core 21, it is fed by a fuel pump etc. from a fuel tank, and the filter 33 from which foreign matters, such as dust in the fuel which flows in a fuel injection valve 10, are removed is formed.
[0021] The fuel which flowed through the filter 33 in the fixed iron core 21 To the clearance between the 2 chamfers formed in the joint 43 of a needle 25 from the adjusting pipe 29, and a pan It passes through the clearance between the cylinder side 261 of a valve body 26, and the 4 chamfers formed in the sliding section 41 of a needle 25, and results in the valve portion which consists of the sheet section (contact section) 251 and the valve seat 263 at a head of a needle 25, and the cylinder side 264 which forms a nozzle hole from this valve portion is reached.
[0022] Next, the configuration of the discharge part 50 of a fuel injection valve 10 is explained based on drawing 4 . Laser welding of the valve body 26 is inserted and carried out to the interior of major diameter 23a of the magnetic pipe 23 through the spacer 27 of hollow discoid. The thickness of a spacer 27 is adjusted so that the air gap between the fixed iron cores 21 and moving cores 22 which are shown in drawing 3 may be held to a predetermined value. The cylinder side 261 on which the sliding section 41 of a needle 25 slides, and the valve seat 263 to which the conic sheet section 251 of a needle 25 sits down are formed in the wall of a valve body 26. Furthermore, the cylinder side 264 is formed in the center of a pars basilaris ossis occipitalis of a valve body 26.
[0023] The flange 36 is formed in the needle 25 so that it may counter through a predetermined clearance from the soffit side of the spacer 27 held in the wall of major diameter 23a of the magnetic pipe 23. The sliding section 41 whose sliding is attained is formed in cylinder side 26a which this flange 36 is formed in the sheet section 251 side formed at the head of a needle 25 among the overall lengths of a needle 25, and is formed in a valve body 26 under the flange 36.
[0024] And it flows to the outlet of the cylinder side 264 of a valve body 26, and the controlling mechanism 51 is established. This flow controlling mechanism 51 consists of a configuration of a needle 25, a valve body 26, and an orifice plate 52, locations, these combination, etc., as shown in drawing 1 , and 2 and 5.
[0025] Hereafter, sequential explanation of these descriptions is given, respectively.
(1) As needle 25 needle 25 is shown in drawing 1 , the solid cylinder side 61, the cone slant face 62, the cone slant face 63, and the spherical surface 64 are formed in the point. Each of these fields 61, 62, 63, and 64 are formed so that a borderline may become circle-like one by one, and the line of the boundary of the solid cylinder side 61 and the cone slant face 62 in a circle serves as the contact section (sheet section) 251. Drawing 1 shows the clausilium condition, the contact section 251 and a valve seat 263 serve as a contact in the state of this clausilium, and the aggregate of this contact serves as a line in a circle.
[0026] ** As the spherical surface 64 is shown in drawing 2 , it is formed on the curved surface approximated to the spherical surface or the spherical surface, and the slot 65 in a circle is formed in the head center section.
** It is a part equivalent to a part of turbulence control means given in a patent claim, the slot 65 in a circle is formed in the concave so that a base may turn into a smooth surface, and if it sees from a needle head side, it is formed in the slot in a circle. If the fuel style which flows into a needle head side from the sheet section 251 at the time of the lift of a needle 25 flows to a center-section side along with the spherical surface 64 and flows into the slot 65 in a circle, it will be that passage is expanded in this slot 65 in a circle, and will produce the circular vortex (longitudinal vortex) of needle shaft orientations. When this fuel style flows into the orifices 54, 55, 56, and 57 which an orifice plate 52 mentions later, it becomes the eddy (horizontal eddy) of the direction of a needle shaft right angle by the fuel inflow to orifices 54, 55, 56, and 57. Since the fuel style in which this longitudinal vortex and a horizontal eddy exist simultaneously is formed, a fuel style becomes it is remarkable and unstable by the entrance side of an orifice plate 52, and the atomization of a fuel is promoted when an unstable fuel style flows out orifices 54, 55, 56, and 57.
[0027] ** Heights 66 are formed in the head center section of the needle 25, and are located in the center section of the slot 65 in a circle. The apical surface of these heights 66 is a flat side-like mostly. A vortex becomes remarkable inside the slot 65 in a circle located in the perimeter of these heights 66.
(2) Valve body 26 valve body 26 consists of a cylinder side 264 which forms the cylinder side 261, the cone slant face 262, and cylinder hole which are shown in drawing 4 , and the borderline of each of these fields 261, 262, and 264 has

become circle-like. The valve seat 263 formed in the cone slant face 262 is in the location where the sheet section 251 of a needle 25 can contact. The cylinder side 264 is formed in needle shaft orientations in a short distance at extent holding turbulence of the unstable fuel style formed in the slot 65 of a needle 25 in a circle in the entrance side of an orifice plate 52.

[0028] (3) The orifice plate 52 which constitutes a part of flow controlling mechanism 51 as a plate for orifice-plate 52 flow directional control is for example, a product made from stainless steel, and as shown in drawing 4 (A) and (B), it is joined at the head of a valve body 26 by welding, for example, full circled welding. Four orifices 54, 55, 56, and 57 are penetrated and formed in the direction of board thickness at this orifice plate 52.

[0029] ** Although four orifices 54, 55, 56, and 57 (henceforth "holes 54, 55, 56, and 57") are formed in this case, each hole 54, 55, 56, and 57 is formed in the shape of [of a cylindrical shape] direct, and as shown in tilt-angle drawing 4 of an orifice (hole), as that cylinder medial-axis line is shown in drawing 1 , only the tilt angle alpha inclines rather than the board thickness directional traverse.

[0030] In this example, it is the example of the 2 direction fuel spray. For example, as shown in drawing 6 , it turns to the umbrella part of one inlet valve 102 from a hole 54 and a hole 55, and it is the fuel style F1. It is injected, it turns to the umbrella part of the inlet valve 101 of another side from a hole 57 and a hole 56, and is the fuel style F2. It is injected. The tilt angle alpha of these holes 54, 55, 56, and 57 has the desirable range of 10<=alpha<=40 (degree), and the value of alpha is suitably set up according to an engine specification.

[0031] ** The location holes 54, 55, 56, and 57 of an orifice (hole) are formed in the location where the mainstream which flows the clearance between a needle 25 and a valve body 26 does not pass through holes 54, 55, 56, and 57 directly at the time of valve opening. By the entrance side of holes 54, 55, 56, and 57, the mainstream of a fuel style can be drawn near to a circular sulcus 65, and turbulence of a fuel style increases. From the inlet port of holes 54, 55, 56, and 57, along with the tilt angle alpha toward which these holes 54, 55, 56, and 57 incline, the fuel passing through the outlet of holes 54, 55, 56, and 57 is formed with a sufficient precision, and is injected.

[0032] The 1st example of the above is an example which applied this invention about the thing of the 2 direction injection method as shown in drawing 6 . The example of this 2 direction injection method is briefly explained about drawing 6 . As shown in drawing 6 , inlet valves 101 and 102 are attached in the inlet ports 162 and 163 which carry out opening to the combustion chamber 161 of an engine 160 possible [closing motion]. The wall 164 which divides both ports is formed between the inlet port 162 and the inlet port 163. The fuel injection valve 10 equipped with the flow controlling mechanism 51 is attached so that it may become in the direction which turns a fuel to the umbrella part of inlet valves 101 and 102, and injects it.

[0033] When the needle 25 and the valve body 26 have estranged according to this 1st example, When the fuel which flows in the direction of the cylinder side 264 along the cone slant face 262 in drawing 1 near the valve seat 263 passes along the clearance between the cone slant faces 62 and 63, the spherical surface 64, and the cone slant face 262, By drawing the flow of a fuel near to the base side of the slot 65 in a circle, the mainstream sense is changed and a vortex occurs inside the slot 65 in a circle. Since a fuel style becomes unstable by the entrance side of orifices 54, 55, 56, and 57 by this, it is effective in the atomization of the fuel spouted from orifices 54, 55, 56, and 57 being promoted. Simultaneously, the directional control of the fuel spray of the fuel spouted from orifices 54, 55, 56, and 57 is controlled by orifices 54, 55, 56, and 57 by the precision.

[0034] (The 2nd example) The 2nd example of this invention is shown in drawing 7 . The 2nd example shown in drawing 7 is an example which formed the flat side in the point of a needle. As shown in drawing 7 , in accordance with the internal-surface configuration of a valve body 26, the curved surface 74 in a circle is formed in the point of a needle 25. As shown in drawing 7 , by the shape of a conical surface, a basic form is formed so that the longitudinal section may have point of inflection, and, as for a curved surface 74, the latest section is formed in the flat side 75. The flat side 75 is mostly formed in parallel with the inlet-port side of an orifice plate 52, and is set as cage predetermined height h.

[0035] Outer diameter D1 of the flat side 75 The maximum outer diameter d1 of the orifices 54, 55, 56, and 57 in the inlet-port side of an orifice plate 52 It has become above (D1 >=d1). When a needle 25 estranges from the cone slant face 262 of a valve body 6 by this, A fuel style the clearance between the cone slant face 262 and the cylinder side 264, and a curved surface 74 A passage, It is made for the mainstream of this fuel style not to have direct passing through in the orifices 54, 55, 56, and 57 of an orifice plate 52. The fuel style which flows to an orifice-plate 52 side in accordance with the field configuration of a curved surface 74 collides with the inlet-port side of an orifice plate 52. It becomes in the style of [unstable] a fuel between the flat side 75 and the inlet-port side of an orifice plate 52. A fuel style goes into orifices 54, 55, 56, and 57 in the state of this unstable fuel style, the fuel spray of the fuel is carried out from orifices 54, 55, 56, and 57 after that, and the atomization of this fuel by which the fuel spray was carried out is promoted.

[0036] Since the flat side 75 is formed in the point of a needle 25 according to this 2nd example, The fuel style which

flowed and progressed from the sheet section 251 cannot flow into the direct orifices 54, 55, 56, and 57. After being bent in the direction of space between the flat side 75 at the head of a needle 25, and the inlet-port side of an orifice plate 52, fuel styles collide and suit and a fuel style spouts from a fuel style and the orifices 54, 55, 56, and 57 almost near the direction of a right angle. Therefore, the flow direction of a fuel becomes unstable by the entrance side of orifices 54, 55, 56, and 57, and it is effective in the atomization of a fuel being promoted by the outlet side of orifices 54, 55, 56, and 57.

[0037] In this invention, the number of the hole formed in the orifice plate as a plate for flow directional control is not restricted, and the dip direction of a hole is not restricted to it by the special include angle, either. Moreover, although directional control of a fuel is performed by using an orifice plate, as long as it has the flat-surface section to which even the hole which lets a fuel pass after the mainstream of a fuel colliding shows a fuel, the means which controls the direction of a fuel may not be restricted to a plate-like thing, but may be a sleeve-like thing, and may be the other plates for directional control again. Furthermore, although the above-mentioned example explained the example of the 2 direction injection, this invention is applicable also to an one direction injection method.

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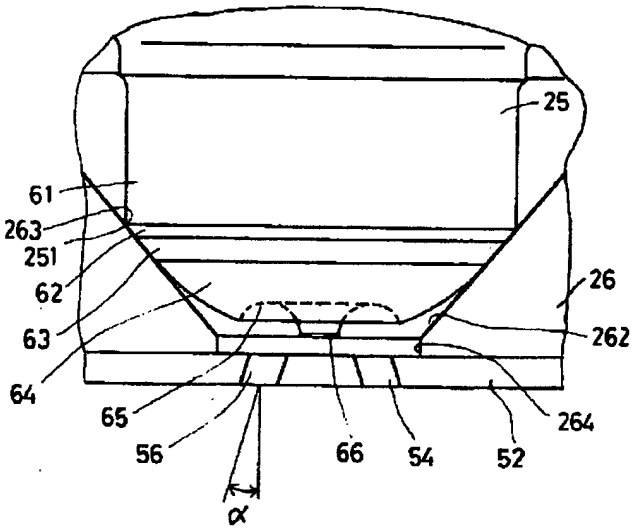
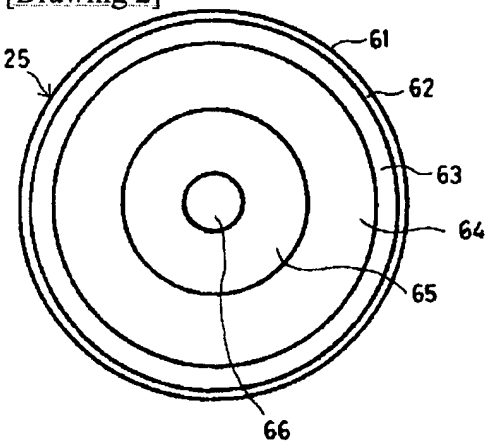
DRAWINGS

[Drawing 1]

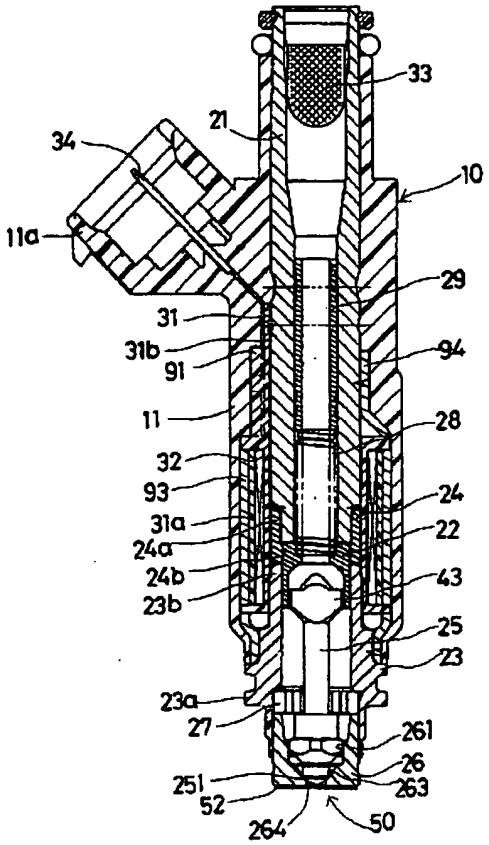
第１実施例



[Drawing 2]



[Drawing 3]



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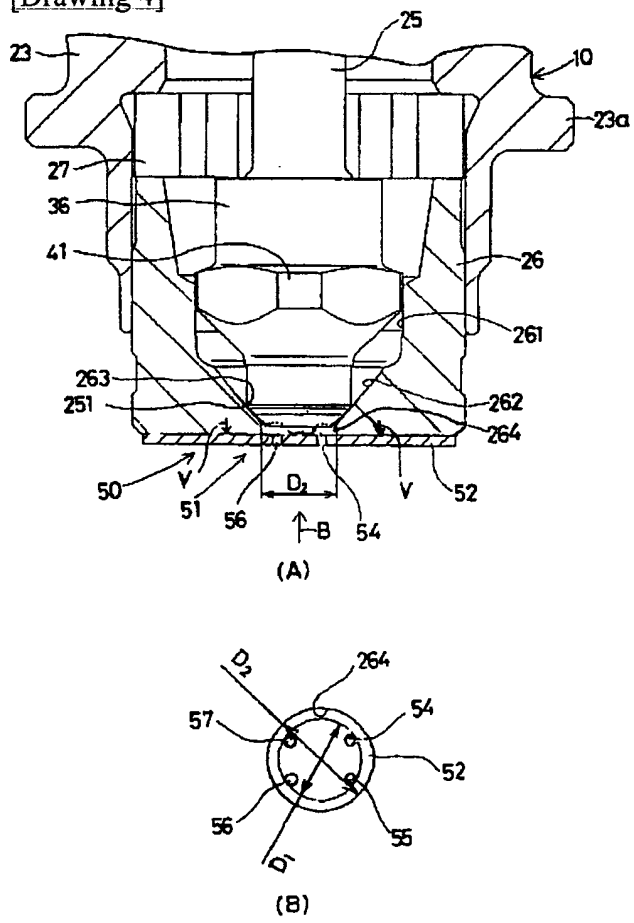
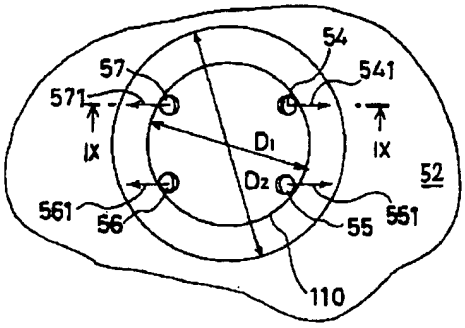
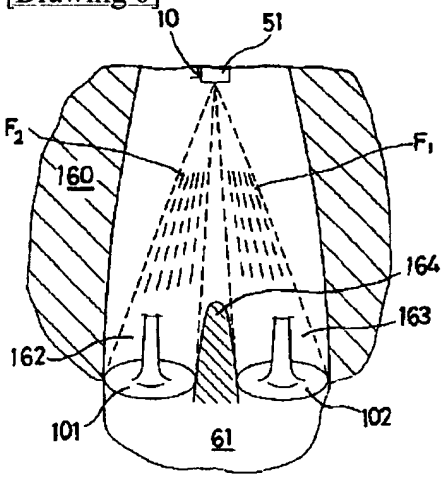


[Drawing 5]

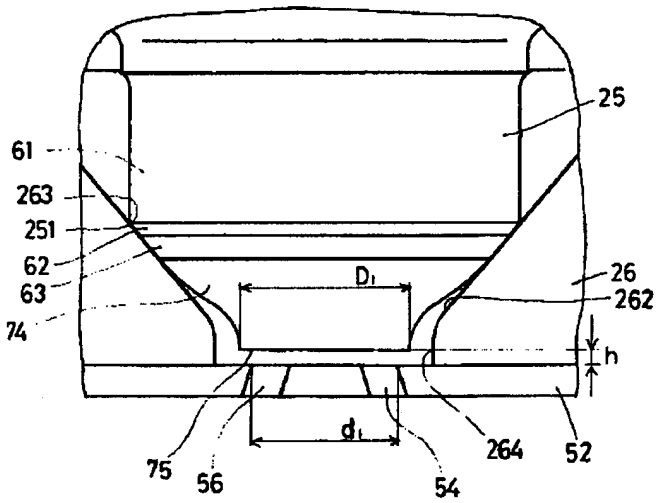


[Drawing 6]



[Drawing 7]

第２実施例



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